States of Matter

Solid

Liquid

Gas

Plasma

Your turn…

Write four (4) examples each for Solids, Liquids, and Gases. Try to use examples you have personally been in contact with

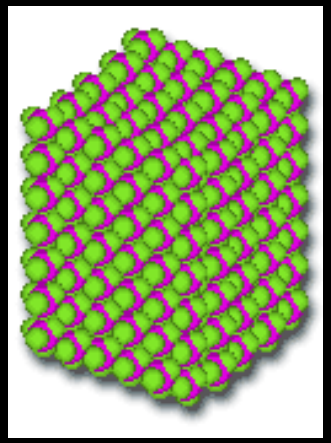
How they relate

Based on what you know about solids, liquids, and gases, how are the twelve (12) examples you came up with different, five (5) ways, and how are they similar, five (5) ways

The Three States of Matter We Will Consider…

Solids –

- **Orderly arrangement of particles that compose it: atoms, molecules, or ions**
- **Held in close proximity and are held together by forces that keep them in fixed positions**
- **Do not flow; difficult to compress**



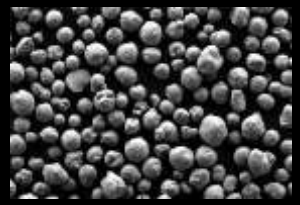
The Three States of Matter We Will Consider…

Solids –

- **Volume and shape are constant because of fixed position**
- **When heated, particles gain energy and the solid becomes a liquid**
- **Identified by and (s) in chemical equations**

Fe_2O_3 (s) + Al (s) → Fe (s) + Al_2O_3



Recall

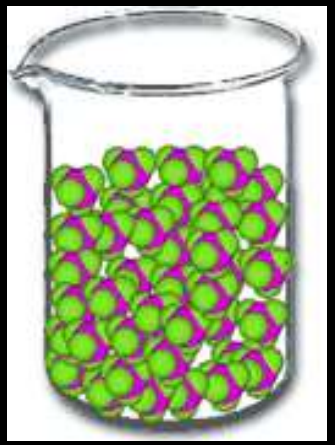
How do your “solids” that you listed fall into or are supported by the definition of a solid just listed?

Tell your neighbor and be prepared to share

The Three States of Matter We Will Consider…

Liquid –

- **Particles are farther apart than those of a solid, but still fairly close to one another**
- **Greater distance between particles allows them to flow**
- **Difficult to compress because the particles remain in contact even as they move about**



The Three States of Matter We Will Consider…

Liquid –

- **Volume of a liquid is constant, but liquids can flow to change shape into that of its container**
- **Cooled = solid; heated = gas**
- **Identified by a (l) in a chemical equations**

H_2O (s) → H_2O (l)

The Three States of Matter We Will Consider…

Gas –

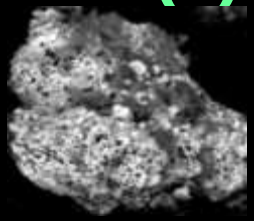
- **Very large distances between particles that are moving at high speeds – 300 m/s**
- **Can be compressed because of large spaces between particles**
- **Always fill the volume and shape of the container in which they are placed**

The Three States of Matter We Will Consider…

Gas –

- **Flow because particles are in constant motion**
- **Identified by a (g) in a chemical equations**

$2\ HCl\ (aq) + Zn\ (s) \rightarrow ZnCl_2(aq) + H_2(g)$

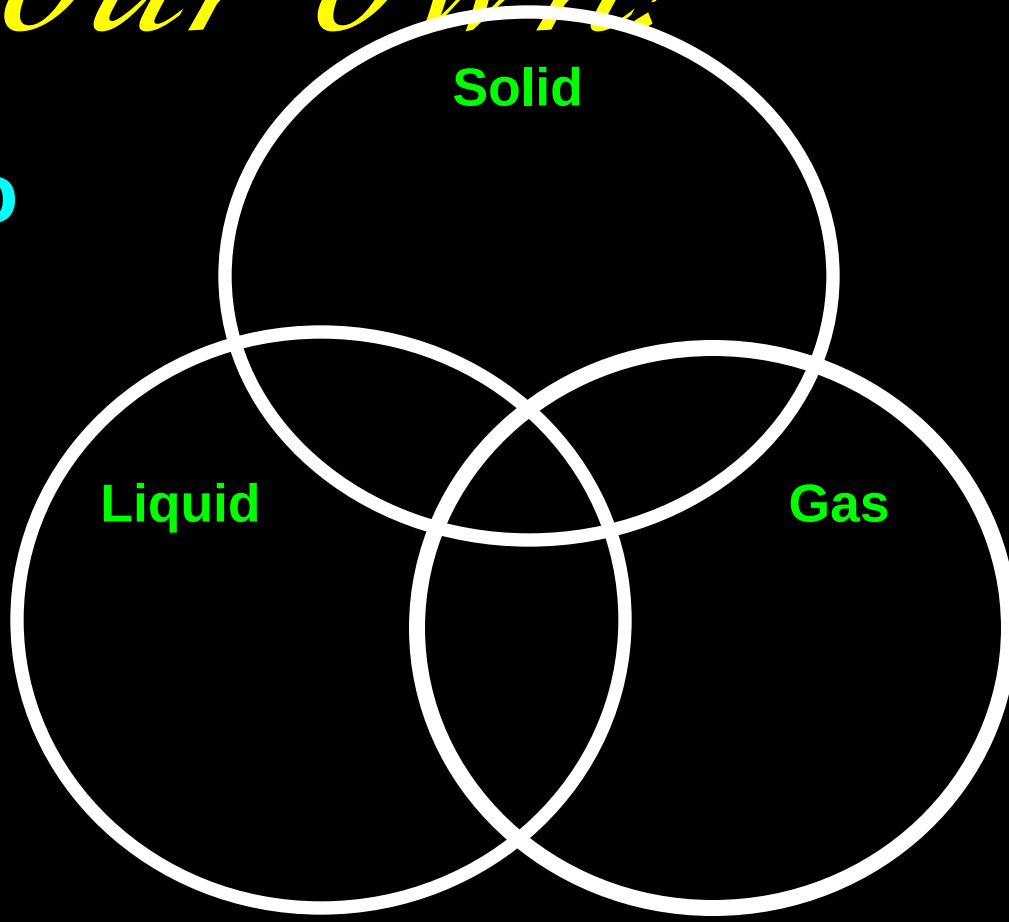


States of Mater link

http://www.google.com/url?q=http://www.youtube.com/watch%3Fv%3Ds-KvoVzukHo&sa=X&ei=1v9gTtXPOM_SiAKVtcGwDg&ved=0CDcQuAIwAA&usg=AFQjCNG2xSidH7SevFEYF8cep9yy5ae_rQ

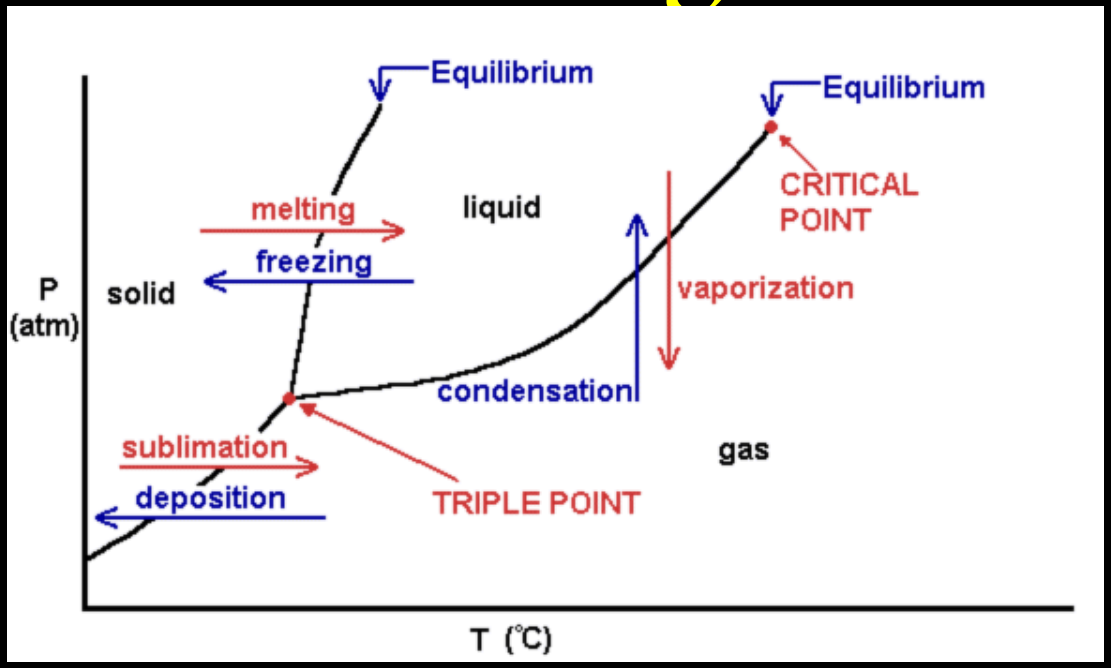
Make it your own!

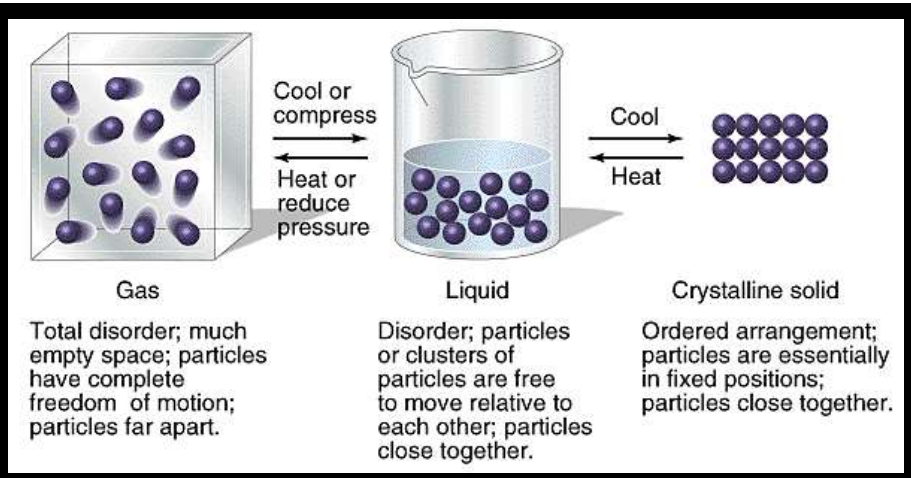
Put these notes into a different form – a table or Venn diagram!



How would a bubble fit into each of the states/ phases of matter?

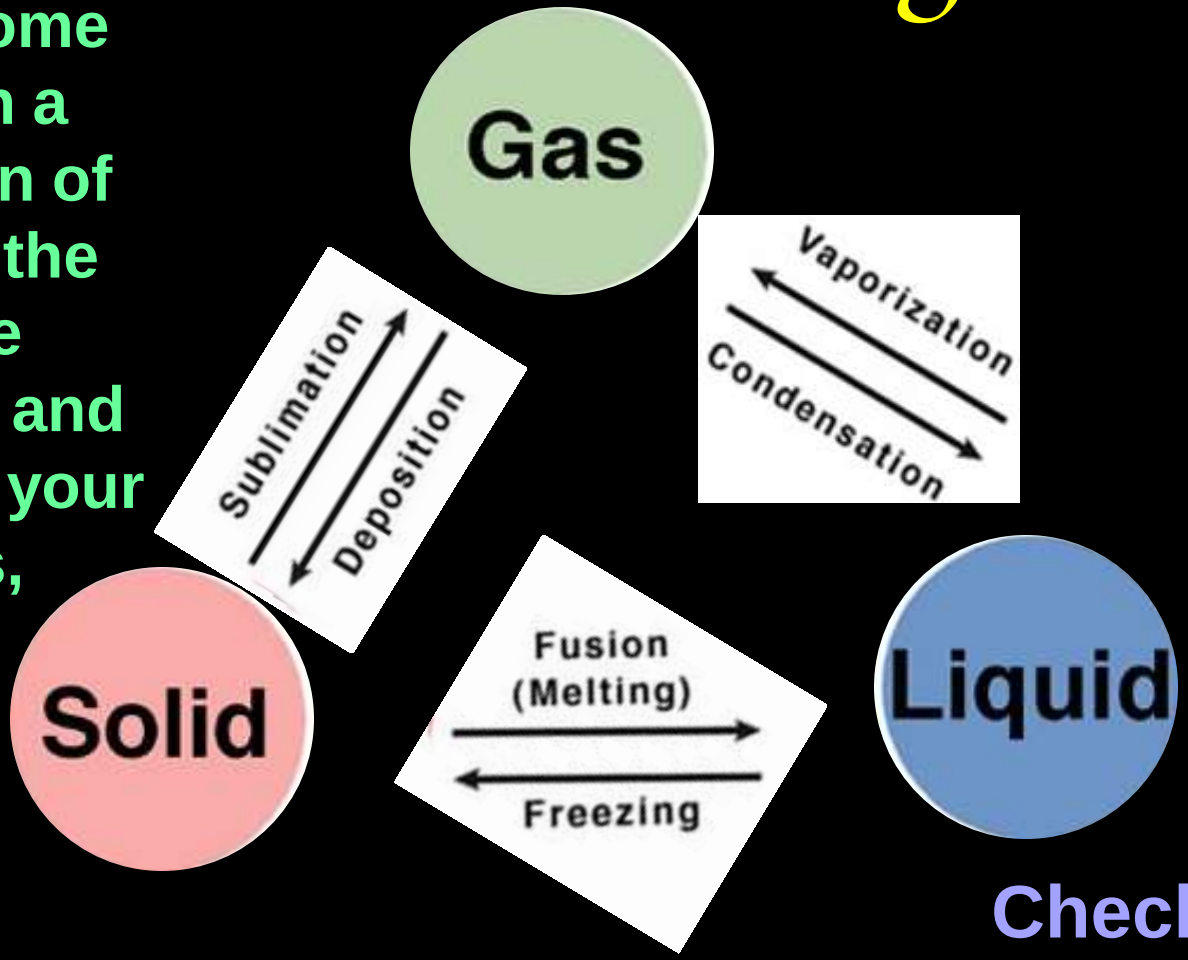
Phase Diagram





Phase Changes

Try to come up with a definition of each of the phase changes and record in your notes,



Check your definitions against the text book

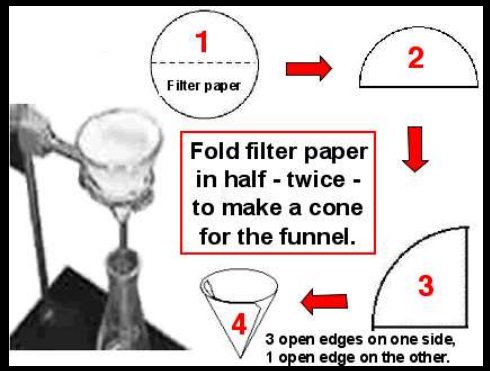
Data Set Up

	Mass (g)	Mass Dish + Sample (g)	Mass of Dish after heating (g)	Difference in Mass, loss of mass (g)
Dish A (Steps 1-3)				
NH_4Cl				
Dish B				
Watch Glass				
NaCl				
Filer Paper			(Dry filer paper and solid)	
SiO_2				

Separation of a Homogeneous Mixture

Separation #2

Separation #1



http://crescentok.com/staff/jaskew/isr/chemistry/liquidkey.htm

Separation #3

Separation of a Homogeneous Mixture

Day #1

We will be doing steps 1-9 today ☺

You will use set ups in hoods for step 2

Complete Step 5, 9, and 10 on Day 2

Separation of a Homogeneous Mixture

Day #1

Step 3, what is the caution there

Separation of a Homogeneous Mixture

When heating the filtrate, in the evaporating dish - use on a small to medium flame!

Separation of a Homogeneous Mixture

Before You Leave:

Describe what was removed in each of the steps and why we used this order for the separation of the mixture.

Which parts of the mixture a soluble in water? How do you know?

Time to Think…

A copper refiner produces a copper ingot having a mass of 1.71 lb If the copper is drawn into wire whose diameter is 10.5 mm, how many m of copper wire can be obtained from the ingot? The density of copper is 8.94 g/cm^3

Separation of a Homogeneous Mixture: Day #2

In the lab you will find the mass of the last component in the filter paper (SiO_2).

Make sure you do not loose any of the SiO_2 while moving it to weigh

Percent composition = $\frac{\text{grams of part}}{\text{total mass}} \times 100$

When you have finished the post lab questions, try to draw out a pictorial description of what you did to separate the mixture.

Percent Composition

There were three (3) substances in the solution: _____, _____, _____

So the percent composition for SiO_2 would be:

$$\% = \frac{\text{Mass } SiO_2}{\text{Mass of Mixture}} \times 100$$

Sample Data

Data:

	Mass (g)	Mass Dish + Sample (g)	Mass of Dish after heating (g)	Difference in Mass, loss of mass (g)
Dish A (Steps 1-3)	*30.20*	*32.90*	*32.70*	*0.20*
NH_4Cl	*0.20*			
Dish B	*30.20*	*NA*	*30.59*	*0.39*
Watch Glass	*NA*	*NA*	*NA*	*NA*
NaCl	*0.39*			
Filer Paper	*1.13*	*NA*	(Dry filer paper and solid)	*3.23*
SiO_2	*2.10*			

Sample Percent Composition

So the percent composition for SiO_2 would be:

$$\% SiO_2 = \frac{2.1g}{2.7g} \times 100 \rightarrow \_\_\_\_\_$$

So the percent composition for NH_4Cl would be:

$$\% NH_4Cl = \frac{0.2g}{2.7g} \times 100 \rightarrow \_\_\_\_\_$$

So the percent composition for NaCl would be:

$$\% NaCl = \frac{0.39g}{2.7g} \times 100 \rightarrow \_\_\_\_\_$$

Why do they not add up to 100% ?

What is a physical change?

A physical change occurs when a substance changes states but NOT chemical composition.

For example:
water freezing into ice,
cutting a piece of wood into smaller pieces, The form or appearance has changed, but the properties are the same
melting point, boiling point, chemical composition, etc.

Characteristics of Physical Properties

Melting point

Boiling point

Vapor pressure

Color

State of matter

Density

Electrical conductivity

Solubility

Adsorption to a surface

Hardness

What are chemical changes?

A chemical change occurs when a substance changes into something new.

This occurs due to heating, chemical rxn, etc. You can tell a chemical change has occurred if the density*, melting point or freezing point of the original substance changes.

Common signs of a chemical change can be seen (bubbles forming, mass changed, etc).

Characteristics of Chemical Properties

- **Rxn with acids**
- **Rxn with bases (alkalis)**
- **Rxn with oxygen (combustion)**
- **Rxn with other elements**
- **Ability to act as oxidizing/ reducing agent**
- **Decomposition into simpler substances**
- **Corrosion**

Sublimation of I_2

I_2 (s) → I_2 (g) → I_2 (s)

What did we do to cause the sublimation of I_2?

What did we do to allow the deposition I_2 (g) to I_2 (s)?

You Think

What are three (3) examples of physical changes you have seen?

What are three (3) examples of chemical changes you have seen?

Separation of a Homogeneous Mixture

Post lab Question 10.

Draw out all of the set ups for the three separation we conducted. Label the components in each.

Recall

Three (3) signs of a chemical change could be…?

What is the volume occupied by 35mg of gallium with a density of 5.32g/cm^3?

Draw a phase diagram for water (H_2O) disregarding actual values for Pressure and temperature. Include the triple point and critical point.

Phase change of Br_2 Gas

Br_2 (g) → Br_2 (l) →Br_2(g)

What are the names of the *two* processes above?

Br is a diatomic gas at room temp. Find it on the periodic table?

What other elements are in the same column?

Name two other elements that are gasses at room temp. (25°C)

EtOH, C_2H_5OH, and water

We will combine 25.0mL of H_2O, 1.00 g/mL with 25.0mL of Ethanol, C_2H_5OH 0.789 g/mL…

Volume H_2O	
Volume C_2H_5OH	
Mass of H_2O	
Mass of C_2H_5OH	
Mass of empty grad. Cylndr.	
Mass of full grad. Cylndr.	
Total volume when combined	
New density of 1:1 mixture H_2O:C_2H_5OH	

Was this a chemical or physical change, explain and support.

Matter: Pure Substances & Mixtures

Matter and evidence from a crime scene may be either a pure substance or a mixture.

A Pure substance is any form of matter that has a uniform composition and cannot be separated by physical methods such as filtration or evaporation into more than one component

Pure Substances: Elements and Compounds

Elements and compounds are two subclasses of pure substances.

An element is the simplest form of a pure substance.

- **Elements are made of ATOMS – the smallest component of matter that retains all the properties of matter**
- **Each element has unique atoms that are unlike the atoms of any other element.**

Pure Substances: Examples of Elements

EX. Al found in aluminum foil

Lithium, often found in clandestine drug labs where methamphetamine is manufactured.

What are three (3) examples of matter in ELEMENTAL form that you have used?

Time to Think…

A 27.15 g sample of a solid is placed in a flask. Toluene, in which the solid is insoluble, is added to the flask so that the total volume of completely submerged solid and liquid together is 53.71 mL. The solid and toluene together have a mass of 67.58 g. The density of toluene at the temperature of the experiment is 0.9247 g/mL. What is the density of the solid in g/cm^3?

Recall

What are two (2) types of mixtures, and how are they different?

Think back to the book work from last Friday.

Recall

Name two differences in physical or chemical change.

Density Recall

If the surface area of a projected new iPhone 7 is 7,800.5mm² and you are instructed to design a protective plastic cover no more than 0.200mm thick, what is the mass of the plastic you should use if it's density is 1.19g/cm^3?

Pure Substances: Compounds

Matter found in elemental form at a crime scene or anywhere else is rare because most elements react with other substances to form compounds.

A compound is a substance that is made up of two or more elements chemically bonded together.

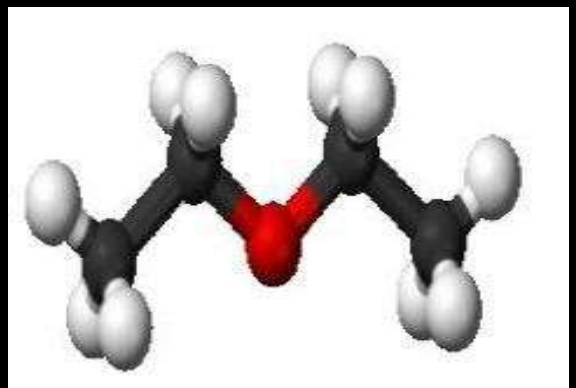
The elements that make up compounds cannot be separated by physical methods but only by a chemical reaction.

Pure Substances: Compounds

Examples of compounds:

- Sodium chloride (NaCl) found in common table salt, in which Na is bonded to Cl
- ethyl ether - in which carbon, hydrogen, and oxygen are bonded in a chemical combination;

What are three examples of COMPOUNDS that you have used?



MIXTURES: Homogeneous & Heterogeneous

Mixtures – two or more substances physically combined but NOT chemically bonded together.

Mixtures can be separated into their components by physical means such as evaporation or filtering.

EX: In order to separate salt from a salt water solution. Just boil the water off.

Heterogeneous Mixtures

The composition varies from one region of a sample to another

Types of mixtures: **Suspensions**

What are four (4) examples of HETEROGENEOUS mixtures that you have used?

Homogeneous Mixtures

Substances are so evenly distributed that a sample from any one part of the mixture will be chemically identical to a sample from any other part.

Only one phase is present

- **EX: sugar dissolved in water;**
- Colliod: Fog, Jello, etc
- EX: Air, and blood.

Mixtures – Homogenous mixtures

What are four (4) examples of HOMOGENEOUS mixtures that you have used?

Ponder this…

What type of mixture is this?

Physical And Chemical Changes Lab

You will have 6min per station.

Some of the stations will only take a few minutes, while waiting complete the assigned question at the lab bench, they all must be completed.

Finish station 1-7in class today

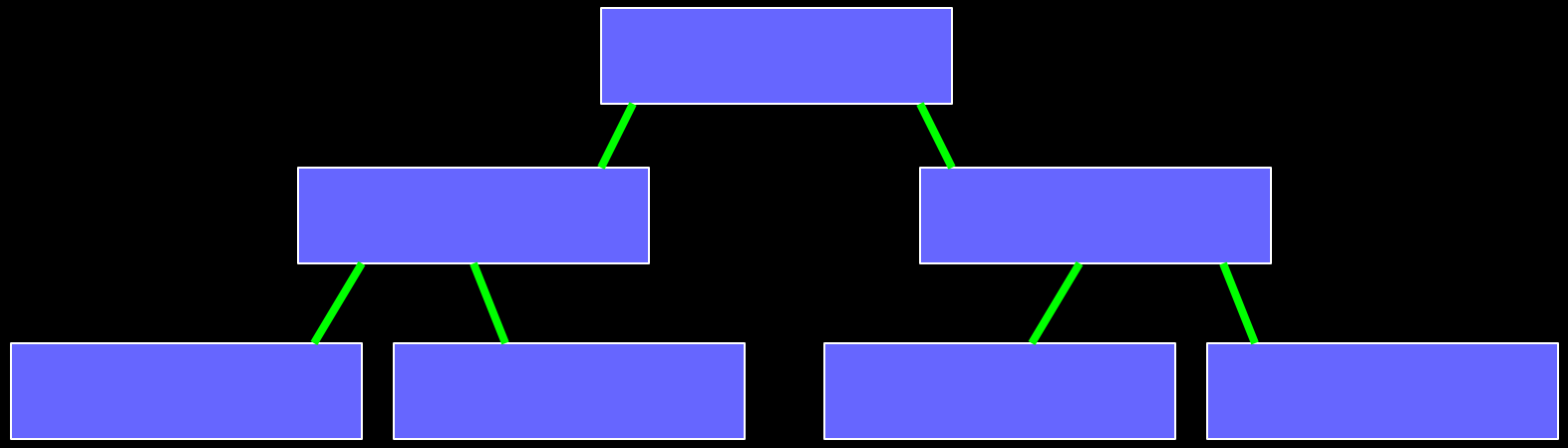
Dimensional analysis Recall

In Lab table groups, you will explain to the class how to get to the answer of your assigned problem.

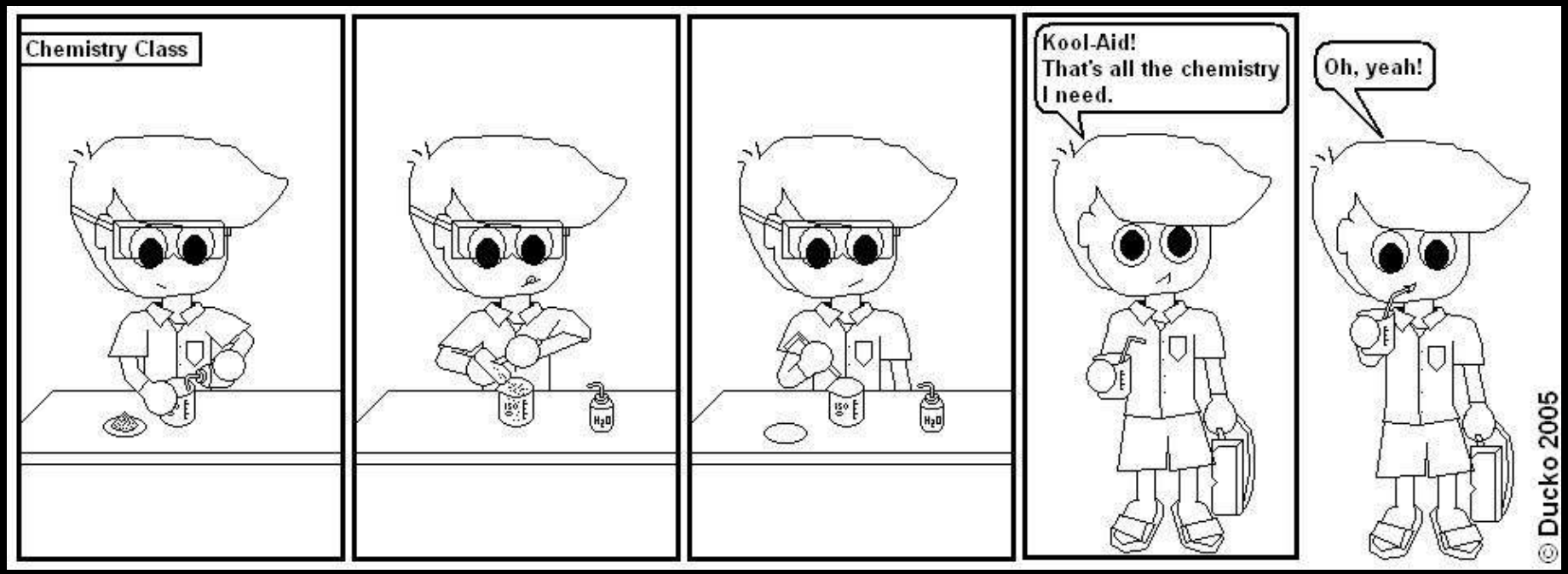
Closure

IN YOUR NOTES, make a flow chart or web outlining Matter and its constituents.

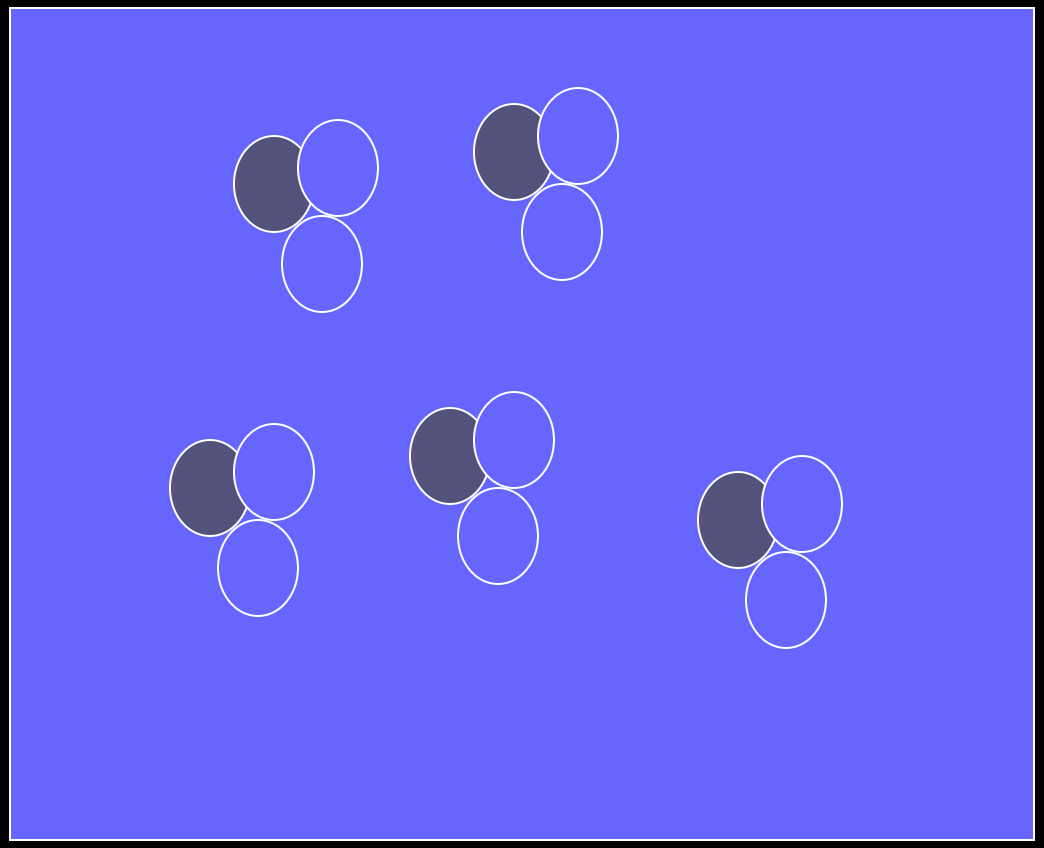
Hint we have not looked at mixtures during class yet, only pure substances…



HA Ha ha…JA Ja ja



Pure Substance or Mixture?



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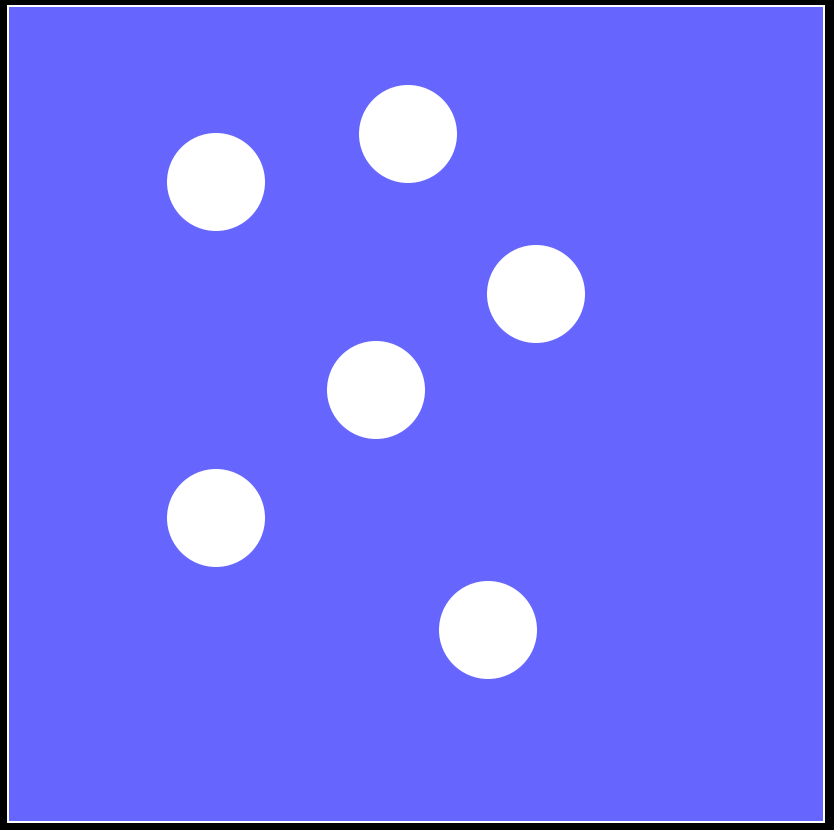

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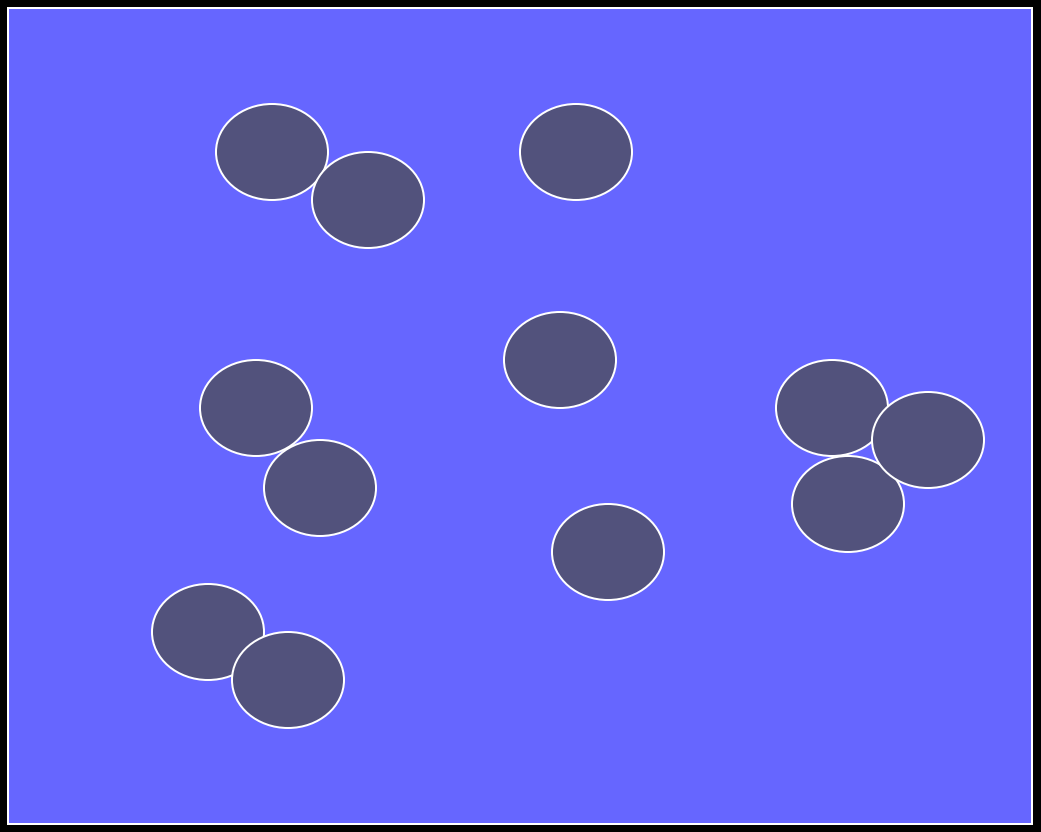

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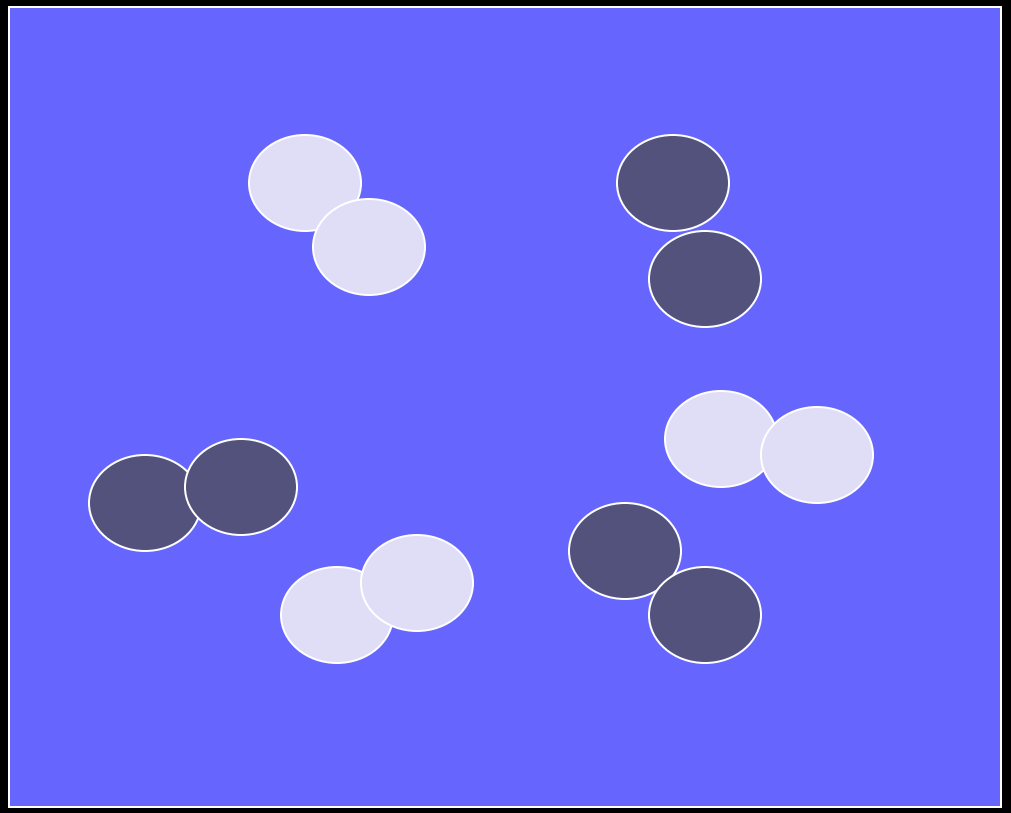
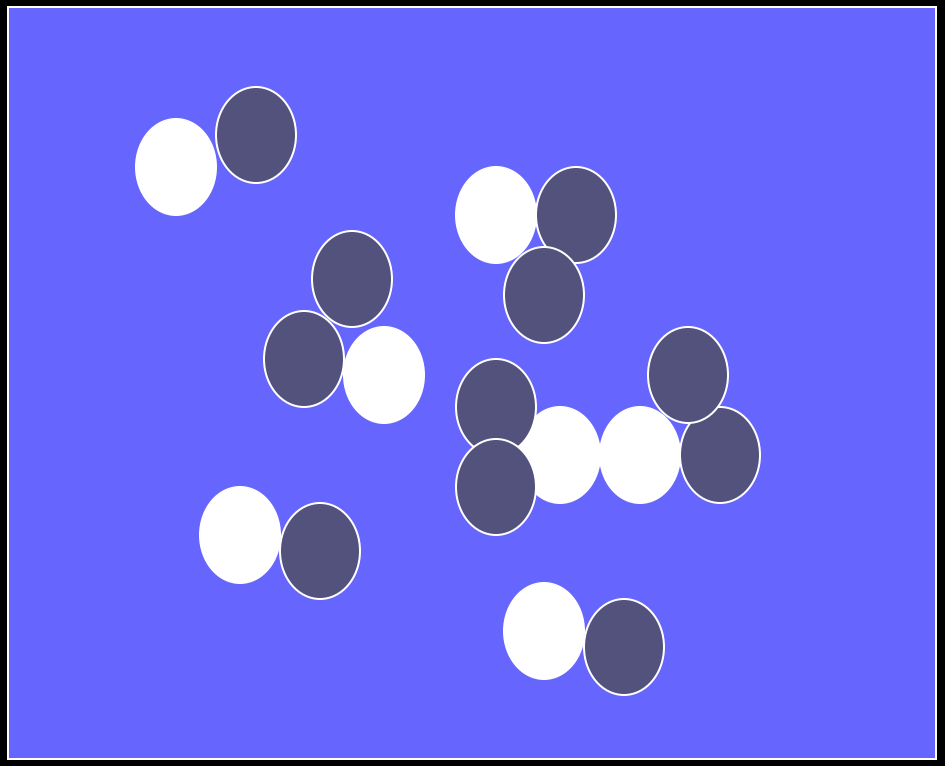


Pure Substance or Mixture?



What type of Mixture

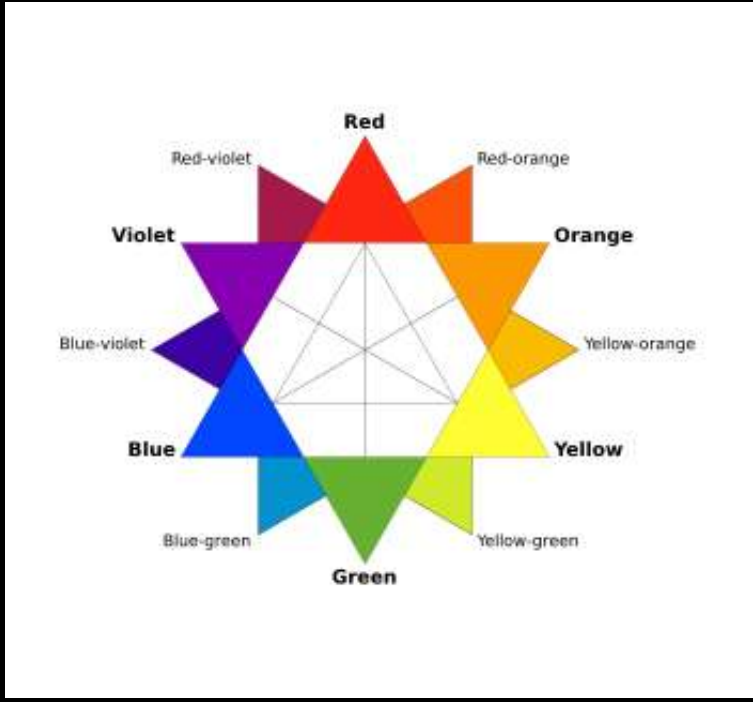
What is the difference between and heterogeneous and homogeneous mixture?

Intensive and Extensive Properties

Physical and chemical properties may be intensive or extensive.

What are intensive properties?

Intensive properties such as density, color, and boiling point do not depend on the size of the sample of matter.



What are extensive properties?

Extensive properties such as **mass** and **volume** do depend on the quantity of the sample.

How can we identify physical properties?

Physical properties are those that we can determine without changing the identity of the substance we are studying.

What are chemical properties?

Chemical properties describe the way a substance can change or react to form other substances.

These properties, then, must be determined using a process that changes the identity of the substance of interest.

EXAMPLES OF PHYSICAL PROPERTIES:

The physical properties of sodium metal (Na) can be observed or measured. It is a soft, lustrous, silver-colored metal with a relatively low melting point and low density.

Hardness, color, melting point and density are all physical properties.

HOW CAN CHEMICAL PROPERTIES BE IDENTIFIED?

One of the chemical properties of alkali metals such as sodium and potassium is that they react with water. To determine this, we would have to combine an alkali metal with water and observe what happens.

In other words, we have to define chemical properties of a substance by the chemical changes it undergoes.

Before you leave…

How are chemical and physical changes distinguished from each other?

Try to make a table or chart for determining if a physical or chemical change is occurring.

Closure

Describe what state(s) of matter is contained in *and* above a glass of ice water? Why

Making the solution

1. Mass out amount needed and add to graduated cylinder

2. Fill about ¾ with water and dissolve, then top off to graduation mark

Slime Lab

Use a 150ml or 250ml beaker to ~~make the~~ slime.

No Not Use a graduated cylinder to measure out the PVAc.

Use a 50ml Beaker to perform the Cold and Hot Tests.

Collecting the data

	Room Temp	Cold	Hot
Flow			
Shape			
Malleable			
Ductile			
Hardness			
S/ L/ G			

Closure

Based on the your findings in the lab, what effect does temperature have on states of matter?

Recall

In the lab we added 20ml of Sodium borate Decahydrate to 40ml of PVAc, what percent of the total solution is the Sodium Borate Decahydrate solution?

Harder:

If the Sodium Borate Decahydrate solution was 4%, what percent of the total solution (Sodium Borate Decahydrate + PVAc) is Sodium Borate Decahydrate?

Objective

You will be able to distinguish between chemical and physical properties and changes